

The Lake Tahoe Atmospheric Deposition Study (LTADS)

December 9, 2004

California Environmental Protection Agency



Air Resources Board

Background



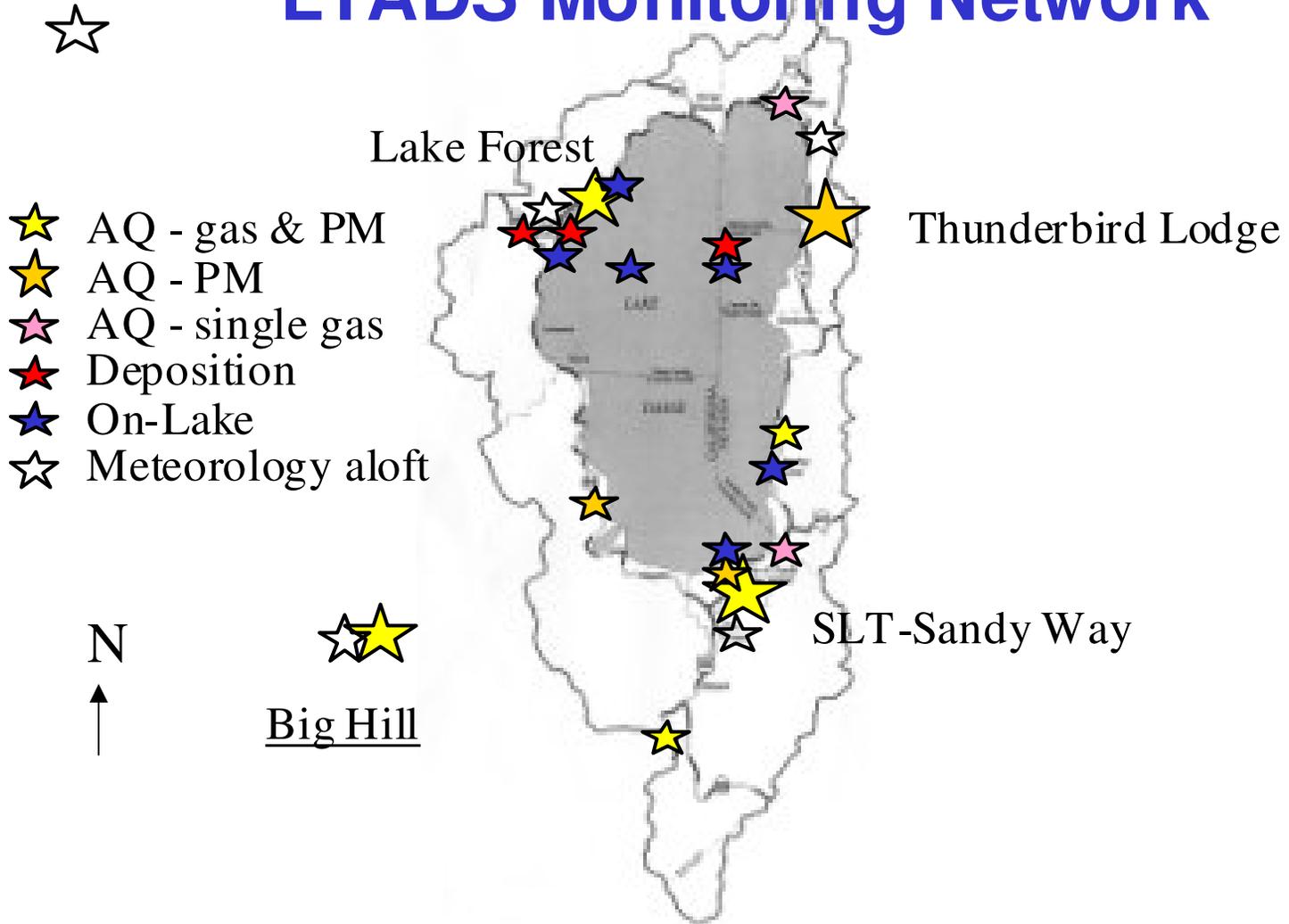
Prior Atmospheric Deposition Work

- Tahoe Research Group's (TRG) deposition bucket sampling program suggests that atmospheric deposition is a significant source of the algal nutrients, nitrogen (N) and phosphorus (P), to Lake Tahoe. Their estimates are:
 - 234 metric tons/yr of nitrogen (59% of total)
 - 12 metric tons/yr of phosphorus (28% of total)
 - Atmospheric particulate matter (PM) falling in the Lake contributes to loss of clarity but is not measured with dep buckets

LTADS Goals and Design



LTADS Monitoring Network



Emission Inventory Improvement

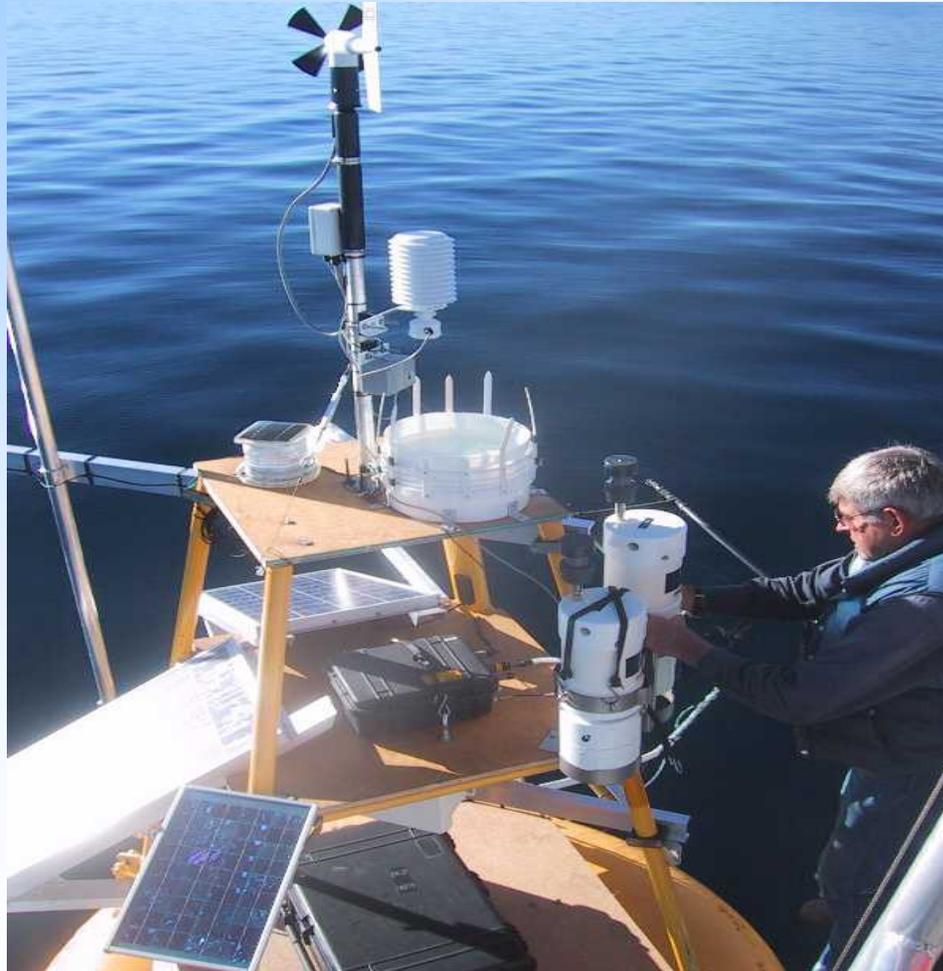
- **Source Sampling**
 - Prescribed Fires
 - Neighborhood Wood Smoke
 - Paved/Unpaved Road Dust
 - Sanding/de-icing
 - Motor Vehicles
- **Activity Characterization**
 - Prescribed & Wild Fires
 - Wood Burning
 - Sanding/de-icing
 - Motor Vehicles



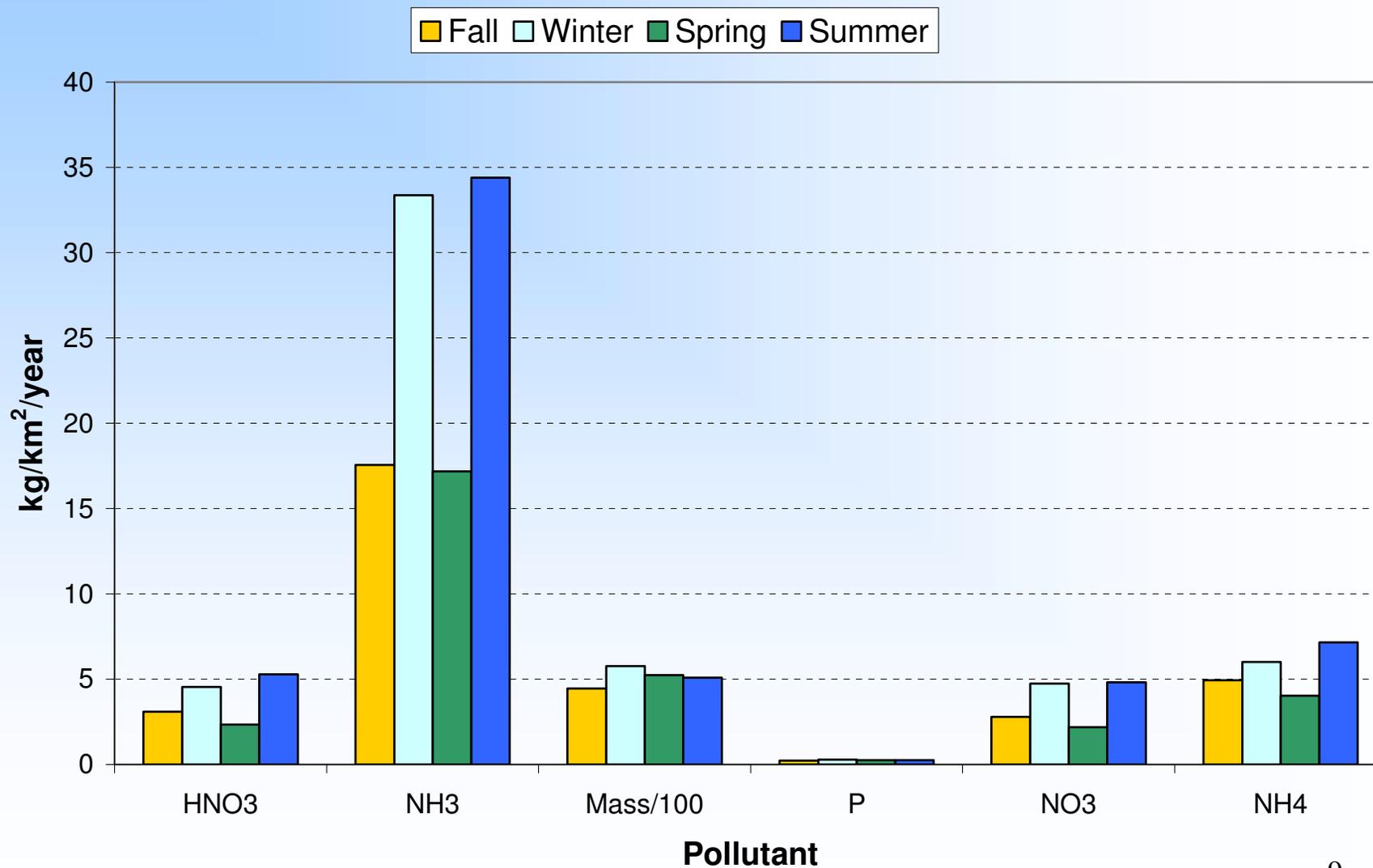
LTADS Products

- Annual and seasonal, spatially-resolved dry deposition estimates of nitrogen, phosphorus, and PM; annual wet deposition estimates
- An inferential source allocation for major sources
- Relative contribution of transport from outside the air basin to observed ozone, nitrogen, phosphorus, and PM in the Tahoe Basin
- Assessment of impacts of air pollution on forest health

Preliminary Findings



N-S Composite Dry Deposition Rates at Lake Tahoe



Estimates of Deposition to Lake Tahoe

(metric tons/year)

Source	ARB	TRG
Dep Type	Dry only	Dry + Wet
Nitrogen	100 - 170	234
Phosphorus	~1	12
PM	1,000 - 2,000	—

Wet vs. Dry Deposition

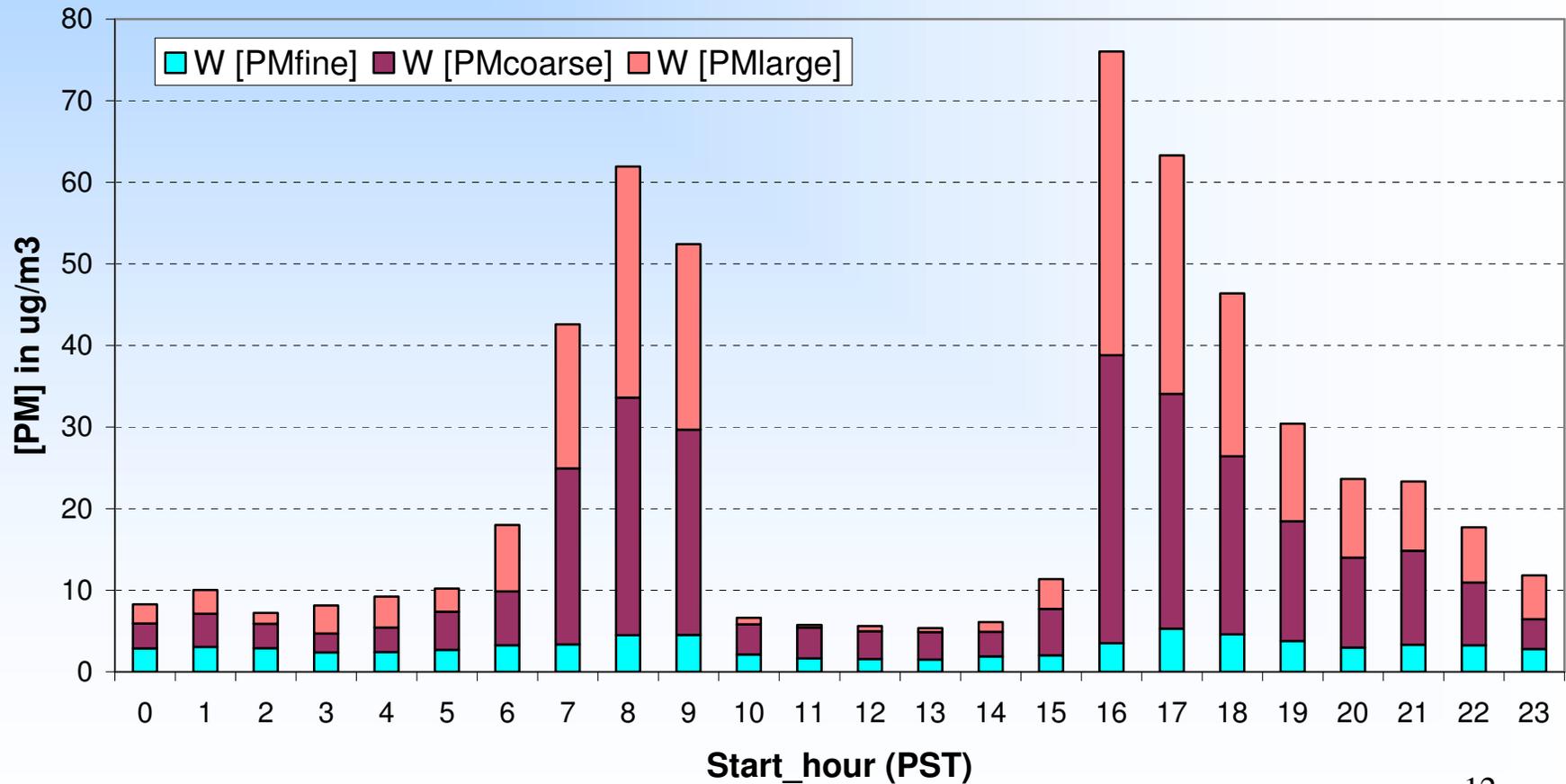
- TRG estimates wet deposition may be responsible for ~ half of total deposition of nitrogen.
- California Acid Deposition Monitoring Program (CADMP) measured wet and dry deposition in the 1990s.
 - If data from 3 rural sites are extrapolated to Lake Tahoe, total nitrogen deposition would be 50 -100 metric tons/year.
 - Wet and dry deposition of nitrogen were roughly comparable
- LTADS initial estimate of nitrogen deposition is reasonably similar to TRG's estimate

Air Quality

Integration of Emissions & Meteorology

Lake Forest Mean Diurnal PM by size

Winter

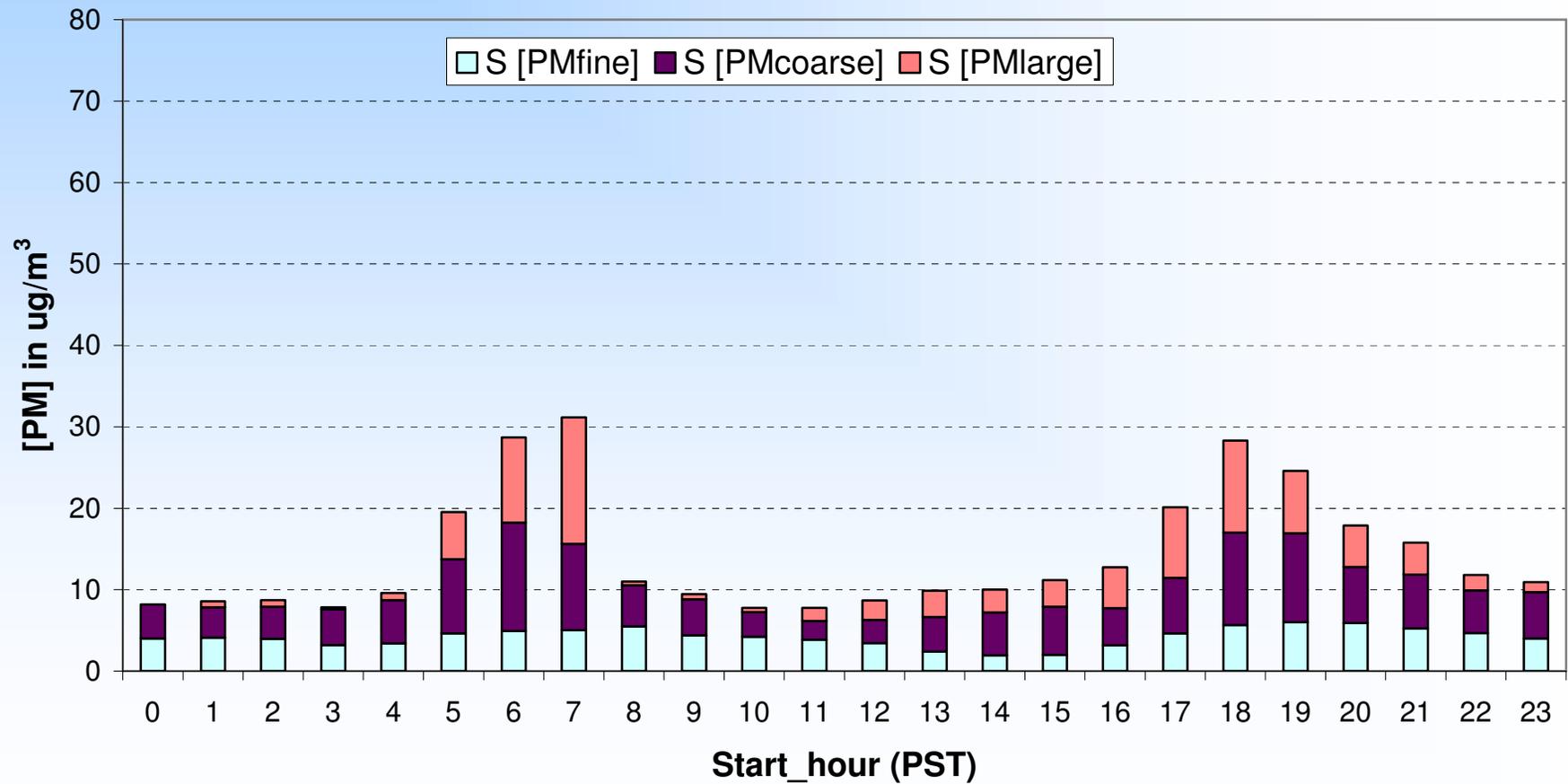


Air Quality

Integration of Emissions & Meteorology

Lake Forest Mean Diurnal PM by size

Summer



Initial Transport Implications

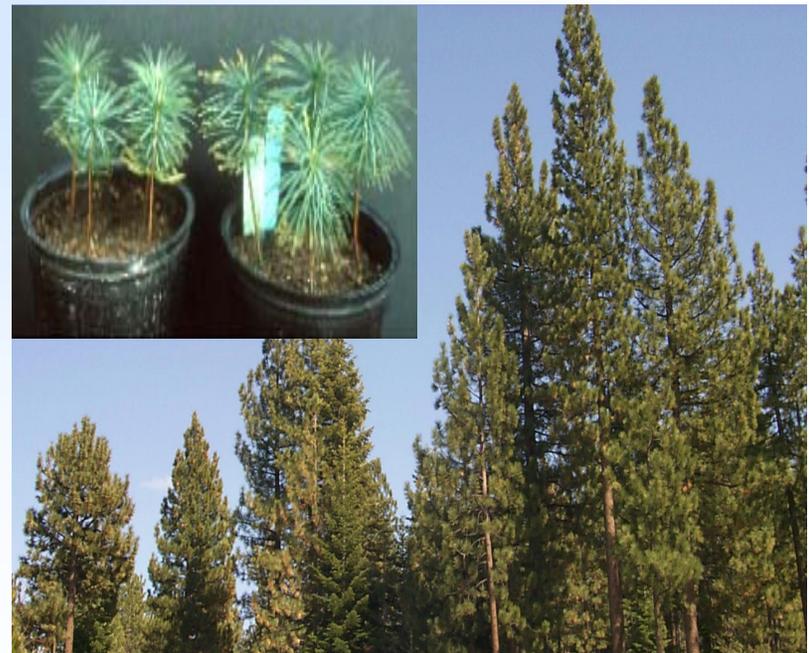
- N - transport limited (mostly ammonia)
- Ammonia – local & regional sources
- Nitric acid – local sources
- Coarse PM - only local sources
- Fine PM - local sources and possibly a regional background including transport of phosphorus from Asian soil
- Phosphorus – primarily of local sources
- Ozone - predominately raised background

Emission Inventory Improvement

- **Improvement of the PM Emission Inventory for the Lake Tahoe Region, UC Riverside**
 - Produced improved estimates of PM emissions from wood burning & improved fleet characterization
- **Lake Tahoe Source Characterization Study, Desert Research Institute**
 - Will provide Tahoe specific profiles for residential wood smoke, road dust and sanding/de-icing materials
 - Will also develop road dust emission factors

Forest Health & Ozone

- Evaluation of Ozone & Nitric Acid Vapor Distribution & Effects on Conifer Forests in the Lake Tahoe Basin & Eastern Sierra Nevada
 - Surveys of ozone injury conducted at 25 sites in basin in 2002
 - 23% of the pines in this area showed slight injury
 - Average injury 17 out of 100



Next Steps



Next Steps

- Deliver initial deposition estimates to lake clarity modelers - December 2004
- Complete data analysis - January 2005
- Develop source identification and transport assessment - February 2005
- Summarize field study - Spring 2005

Acknowledgements

- ARB's Monitoring & Laboratory Division
- ARB's Planning & Technical Support Division
- Tahoe Regional Planning Agency
- Lahontan Regional Water Quality Control Board
- Tahoe Research Group
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- Nevada Division of Environmental Protection
- UC Berkeley, UC Davis, UC Riverside, DRI, NOAA
- Peer Reviewers

Thank you

